Atheroembolization: A harmful complication of therapeutic internal iliac artery occlusion

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Coil embolization of the internal iliac artery (IIA) for proper endovascular treatment of aortoiliac aneurysms is a procedure with an acceptable morbidity rate consisting of buttock claudication in 12% to 55% and erectile dysfunction in 1% to 13%. Atheroembolic complications in this context are not yet reported. We present a case with gangrene of the prepuce and focal cutaneous necrosis of the ipsilateral buttock and foot after coil embolization of one IIA. Multiple atheroemboli were found with the histopathologic examination of the excised prepuce. Atheroembolization is a rare complication of therapeutic IIA occlusion, and the ischemic sequels can be severe because of the coincidence of atheroembolization and occlusion of the main supplying artery. (J Vasc Surg 2002;36:1062-5.)

Endovascular repair of isolated iliac or extensive aortoiliac aneurysms often requires preliminary occlusion of one or both internal iliac arteries (IIAs) to prevent retrograde perfusion of the aneurysm.[1,2] This procedure is performed endovascularly with coils.[1-3] Recognized complications are transient buttock claudication or sexual dysfunction.[1-4] Atheromatous embolization (AE) is a rare but threatening complication of any vascular intervention reported in cardiovascular surgery and angiography.[5] Curiously, corresponding references in the literature after endovascular aneurysm exclusion are sparse.[6-10] AE is defined by repetitive showers of sloughed atheromatous gravel of 1 mm or smaller jammed within arterioles of 100-μm to 600-μm diameter. The source of atheroemboli is mainly an eroded plaque of the abdominal aorta or iliac arteries provoking disseminated miliary infarctions of the terminal vascularity of the viscera, kidneys, lower limbs, and skin with a 72% to 81% mortality rate in case of visceral involvement.[11] A complication of unilateral coil embolization of the IIA is reported consisting of atheroembolic lesions in the penis, ipsilateral buttock, and toes.

CASE REPORT

A 56-year-old man was admitted to our hospital for investigation of an infrarenal aortic aneurysm. History was remarkable for small bilateral popliteal aneurysms, coronary artery disease, hypertension necessitating two antihypertensive medications for control, hyperlipidemia, and smoking. A thallium myocardial scan was interpreted to show reperfusion ischemia in the inferolateral wall of the left ventricle. A computed tomographic scan and a calibrated arteriography revealed an aortic neck free of mural thrombus and suitable for endovascular aneurysm repair, an irregularly dilated right iliac artery, patent IIAs with an orificial stenosis of the left one, and a 70% stenosis of the proximal right renal artery (Fig 1, *A*). The goal of an extensive angiographic investigation was the exclusion of significant coronary artery stenoses in ischemic heart disease and the treatment of an important preocclusive renal artery stenosis in the context of hypertension necessitating medications.

Angiography was performed through a left femoral access, starting with a coronary angiography that was negative for significant stenoses and successful selective stenting of the right renal artery (8/38-mm Jostent, JOMED, Helsingborg, Sweden). Embolization of the right IIA was difficult (Fig 2). The crossover maneuver was easily accomplished with a 5F Cobra Terumo Guidecath over a 0.035-in Terumo guidewire (Terumo Corp, Tokio, Japan), yet the placement of the wire in the right IIA was possible only when the Cobra catheter received an additional shaping by the interventionalist. Six 8/5-mm and two 6/3-mm coils (TORNADO, William Cook Europe, Bjaeverskov, Denmark) were delivered within the proximal IIA. Perfusion of the distally located anterior and posterior branch remained preserved. A final arteriogram showed minimal antegrade flow into the IIA with heparin and correct position of the coils (Fig 2, *B*). The length of the whole procedure was 90 minutes, and the total amount of contrast dye was 150 mL (Imagopaque, Nycomed, Norway). The patient was discharged the next day with slight buttock claudication and normal levels of creatinine and creatinkinase.

The patient was readmitted 7 days later. The prepuce was completely gangrenous. The buttock (Fig 3) and the anterior surface of the knee on the right side showed scattered spots of cutaneous necroses. The tips of the first and second right toe were necrotic and painful. All pedal pulses were preserved, and the ankle/brachial index was 1. Livedo reticularis was absent. Blood results were normal except for a leucocytosis of 13.3 G/L, a C-reactive protein of 45 mg/L, and a slight eosinophilia of 8%. Circumcision resulted in prompt wound healing. Histopathologic examination of the prepuce showed multiple atheroemboli with needle-shaped clefts corresponding to cholesterol crystals lodged within the arterioles (Fig 4). Thromboemboli were not present. A muscle biopsy to confirm the cause of the lesions of the foot was not performed because of lack of consequences. They healed by conservative means, and the patient was discharged.

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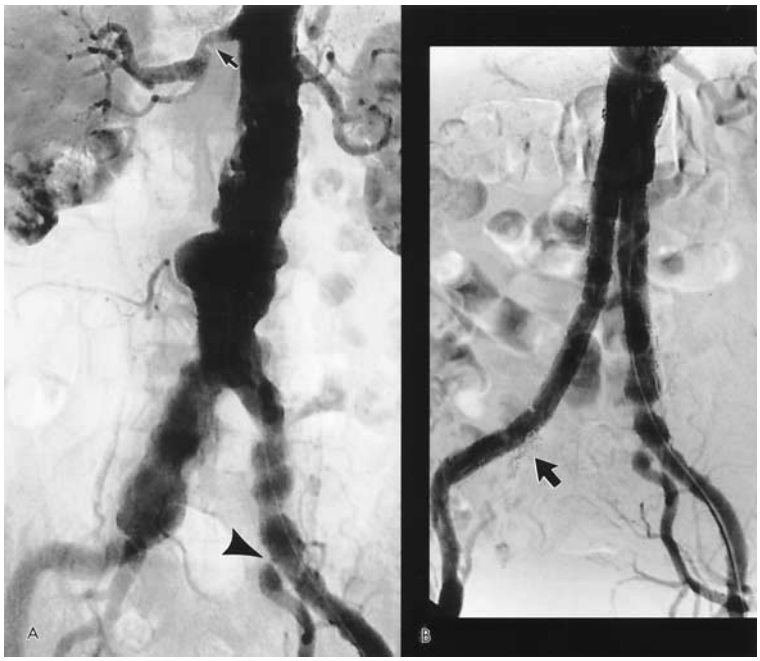

Fig 1. A, Aortogram shows infrarenal aortic aneurysm (diameter, 48 mm) and 70% stenosis of right renal artery *(arrow)*. Common iliac arteries are irregular and aneurysmal, suggesting extensive atherosclerotic disease. Perfusion of both IIAs and orificial stenosis of left IIA *(arrowhead)* are present. **B,** Arteriogram after coil embolization of right IIA *(arrow)* and endovascular exclusion of aortic aneurysm with bifurcated prosthesis.

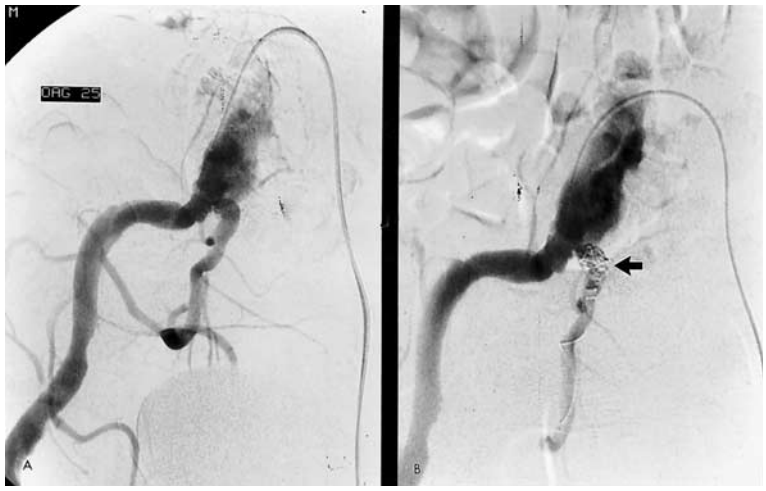

Fig 2. Embolization of right IIA. **A,** Arteriogram of iliac bifurcation shows IIA with its division into anterior and posterior branch. **B,** Completion arteriogram (left anterioobliique projection) shows correct position of coils within proximal IIA *(arrow)* and residual perfusion of IIA from heparinization required by procedure.

A staged endovascular exclusion of the abdominal aortic aneurysm was performed without complications. Immediately before graft placement, the aorta was carefully evaluated with intravascular ultrasound scan. The infrarenal aorta showed a thrombus-free neck, thrombus within the aneurysm, and an extensively diseased right common and external iliac artery. It is known that the introduction of the low profile second limb into the aortic endoprosthesis can necessitate several exchanges of guidewires and catheters. To minimize these manipulations, a right-sided access was chosen for the introduction of the main body of a bifurcated endoprosthesis including one limb (Talent, World Medical Manufacturing Corp, Sunrise, Fla). It was deployed beneath the renal arteries and extended into the external iliac artery (Fig 1, *B*). The second limb was shorter, allowing perfusion of the left IIA. A

Fig 3. Crops of plaque-like areas of cutaneous gangrene localized on right buttock.

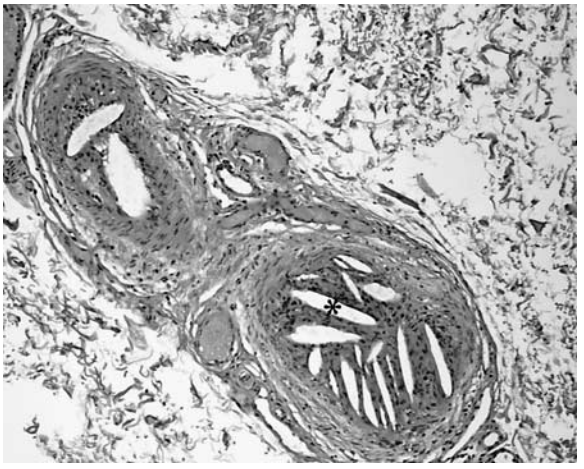

Fig 4. Preputial artery blocked by atheromatous fragment with numerous needle-shaped clefts corresponding to cholesterol crystals* (hematoxylin and eosin stain, ×100 magnification).

duplex and Doppler scan examination confirmed complete exclusion of the aneurysm and an excellent perfusion of the lower extremities. During a 2-year follow-up period, no further event of AE has been observed.

DISCUSSION

AE as a complication of therapeutic endovascular IIA occlusion has not yet been reported. However, significant AE has been clearly shown during endovascular aneurysm repair[10] and represents probably a significant cause of morbidity and mortality. Recent publications elucidated its importance in colon ischemia.[6-8] They identified massive AE into the intestinal vascularity related to endovascular maneuvers for aortic aneurysm repair as the main cause for colon ischemia or fatal necrosis. Unilateral or bilateral endovascular occlusion of the IIA is considered as a relatively safe procedure,[1,3,4] especially if it is staged and the coils are placed proximally in the main trunk of the IIA, allowing retrograde perfusion of the distal branches.[2,3] Reported complications consisted of mostly transient buttock claudication in 12% to 55% and erectile dysfunction in 1% to 13%,[1-4] whereas serious complications, such as manifest colon ischemia, remain anecdotal.[6,12,13] Therapeutic occlusion of the IIA to achieve complete endovascular aneurysm exclusion is necessary in about 20% of abdominal aortic aneurysms extending into the distal common iliac artery[14,15] and in 80% of isolated iliac aneurysms.[16] In these cases, the origin of the IIA is located within an aneurysmal iliac artery often containing thrombus. Endovascular manipulations in this situation present an obvious risk for AE. Regarding the relative frequency coil embolization is required and the morphologic condition in which it is performed, the absence of AE as a complication of therapeutic IIA occlusion in the literature is surprising. However, to what extent AE contributes to the ischemic sequels of therapeutic IIA occlusion is not known.

In this case, the embolic source with regard to the site of the lesions (right buttock and lower extremity) had to be located beneath the aortic bifurcation and above the right iliac bifurcation. We considered the crossover maneuver and the embolization procedure to be responsible for a plaque rupture within the right common iliac artery because the coronary angiogram and the renal stenting were both performed through the left iliac artery. AE into the internal and external iliac artery occurred immediately before the IIA was occluded by the coils, whereas consecutive tissue necroses appeared later. The first clinical symptom in this patient was buttock claudication, which he noticed 24 hours after the procedure, followed by tissue necroses 7 days later. Because of the coincidence, the proven atheroemboli in the prepuce, and the absence of thromboembli, we likewise attribute the lesions of the right toes to atheroemboli after the embolization procedure and not to thromboemboli from coils. However, a muscle biopsy of the gastrocnemius or quadriceps group would have been necessary to establish the cause of the peripheral lesions. Patients with a history of AE, such as renal failure from atheroembolic disease, and patients with aneurysms distinguished by large amounts of thrombus narrowing the lumen are probably at high risk of AE. In these patients, the benefit of endovascular aneurysm repair has to be balanced against the risk of possibly fatal AE.

The severity of the tissue necroses in the territory of the IIA is surprising and more pronounced than the discrete lesions of the toes. Prepuce and cutaneous necrosis of the buttock are manifestations of AE, and only four cases with prepuce or penis gangrene have been reported.[17-19] Three of these patients had an infrarenal aortic aneurysm, and two of them had their symptoms develop 1 week after aortography, a delay consistent with our observation.[17,18] In three patients, multiple organ involvement was present, resulting finally in death.[18,19] Cutaneous necrosis of the buttock is also an unusual symptom of AE. The most common cutaneous manifestation of AE, particularly in the central part of the body, is livedo reticularis in 49%.[11] The severity of the lesions in our patient can be associated with the fact that the

accidental atheromatous showers into the IIA were followed by therapeutic occlusion of the main supplying artery. Simultaneously, the contralateral IIA had a considerable stenosis at its origin probably not able to compensate for the impaired perfusion. Recently, a similar case report has been published showing severe ischemic complications after bilateral coiling of the IIAs.[9] Spotted cutaneous necroses of the scrotum and impairment of penile perfusion were probably the sequels of disseminated atheroemboli in a deficiently perfused territory, yet a skin biopsy was not performed.

In this case, the common iliac artery considered the embolic source was later successfully covered with an aortoiliac endoprosthesis, preventing further atheroemboli. Before the availability of endoprostheses, resection of the diseased artery with replacement of a prosthetic graft or endarterectomy was the treatment of choice to eliminate an atheroembolic source. Today, aortic endoprostheses with complete coverage have been shown to be a useful tool for sealing plaques that release microscopical particles, such as cholesterol crystals,[20] whereas stents consisting solely of a metallic framework are not ideal for covering these kind of lesions entirely. However, the dilemma of avoiding atheromatous showers with endovascular maneuvers before the placement of an endoprosthesis remains the same as in open surgery, where clamping and handling of the vessels are crucial before resection of the artery.

In summary, AE is a rare but probably underestimated complication of therapeutic IIA occlusion preliminary to endovascular aneurysm treatment. The ischemic sequels can be severe because of the coincidence of AE and occlusion of the main supplying artery. Elimination of the atheroembolic source with implantation of an endoprosthesis with a covering can be a treatment option.

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